1. Introduction

It has been suggested that athletic injuries to the stifle may account for >40% of injuries in certain disciplines.1 In the authors’ experience, the prevalence of stifle injuries in most disciplines is not accurately known. Furthermore, until the past 10 to 15 years, very little attention has been given to athletic injuries in the stifle, in part because of diagnostic limitations and lack of successful treatment options.

Limiting definitive diagnosis is the inability to accurately image the soft tissue and bone with high sensitivity and specificity. Although routine radiography can be helpful in certain cases, many lesions, particularly those of soft tissues, go undetected. Ultrasonographic examination of the equine stifle joint has helped broaden diagnosis of stifle lesions. This is especially true of soft-tissue structures, namely the collateral ligaments, patellar ligaments, and menisci. Ultrasound examination of the cruciate ligaments still poses a problem because of the orientation and deep anatomic location of these structures. Moderate to severe pathology appears to be readily detected with the use of ultrasonography,2,3 but detection of slight to moderate lesions is difficult. In a recent study, Cohen et al4 nicely defined the sensitivity (79%) and specificity (56%) of ultrasonography in the equine stifle joint, with surgery used as the gold standard. A positive predictive value (73%) and negative predictive value (62%) were also determined for equine ultrasonography on the basis of this study. These results point out the current limitation of ultrasonography of the equine stifle. Other current methods for diagnostics in the stifle currently require general anesthesia, specifically computed tomography, magnetic resonance imaging, and routine arthroscopy, which remain the gold standards. It is also worth noting that these later diagnostics are typically only available at large referral centers, limiting their availability in a more routine practice setting.

Additional methods to safely and quickly assess the stifle in a typical practice setting would be advantageous to aid a more accurate diagnosis of stifle...
disease. This report outlines the use of an 18-gauge, disposable arthroscope to safely and efficiently provide a complete visualization of the stifle joint in the standing horse.

2. Materials and Methods

Equipment

The 18-gauge needle arthroscope \(^a\) (1.3-mm diameter) is a compact and portable unit that consists of a light source and imaging processor in one console and a camera attached to a cable, which connects with the base console (Fig. 1). The standard 100-mm-long arthroscope and cannula/obturator (2.0-mm outer diameter, OD) systems are disposable and come in a 10° and special-order 30° configuration. A separate, stiffer cannula/obturator (2.5-mm OD) with a 30° scope lens system is available from the manufacturer and was used in all clinical cases (Fig. 1). Fluid distention of the joints is necessary and may be achieved through either the use of a 60-mL syringe, a fluid pressure bag on a 1-L fluid bag, or an automated pressure-sensitive arthroscopic fluid pump system. The fluid used to distend the joint during surgery should have 200 mL of 2% lidocaine/mepivacaine added per liter of fluid.

Patient Preparation

Patients are typically given 2 g of phenylbutazone before surgery and then 2 g daily for three additional postoperative days. Throughout the procedures, horses are administered light to moderate sedation; they are also typically restrained with a nose twitch and in some cases with the use of stocks. Horses are routinely sedated with 10 mg of detomidine intramuscular at the time of initial stifle preparation. The joints to undergo the procedures are blocked separately with the use of approximately 20 to 30 mL of local anesthetic per joint, optimally at least 20 minutes before the onset of the procedure. Next, depending on the amount of organic debris and hair length, the stifle area is clipped with a No. 40 clipper blade and prepared in an aseptic manner as for routine arthroscopic surgery. In some horses that have very short coats, the hair is not clipped. Just before local skin and tissue anesthesia, the horses are typically given 3 mg of detomidine and 5 mg of butorphanol intravenously. Approximately 5 to 10 mL 2% mepivacaine hydrochloride is used to block the skin and deeper tissues at each of the entry portals described in the next section. An additional aseptic preparation of the portal sites follows, with final positioning of the limb. The team typically consists of a surgeon and assistant wearing sterile gloves as well as an assistant to position and help balance the hind limb. The procedure can and has been performed with or without stocks.

The preferred limb positioning is flexed similar to standard arthroscopy.\(^3\) In refractory horses, the

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\(^a\) 18-gauge needle arthroscope

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stifle joints can be entered in a weight-bearing position, but the surgeon must be aware that this changes the shape and position of soft-tissue structures, most notably the appearance of the menisci (Fig. 2). If the limb is entered in a weight-bearing position (minority of the cases), the limb is flexed manually for a short period to visualize the more distal extent of the condyle.

A customized stand is used to hold the limb in flexion (Fig. 3). With the use of this technique, the distal limb is bandaged with a quilt and bandage, then placed in a splint. A custom base has been manufactured to accept the splint and allow for variable flexion of the limb on the basis of how high the base is from the ground (Fig. 3).

At the end of the procedure, either 125 mg of amikacin sulfate or 600 mg of ceftiofur sodium is administered into the joint undergoing needle arthroscopy. The small size of the skin incisions indicates that no suture or other method of closure is necessary; however, the authors have used tissue glue in cases in which bleeding was an issue. Horses are normally stall-confined and observed twice daily for 3 days, and the level of work appropriate to the arthroscopic findings is then outlined.

### Portal Placement

A stab incision just large enough to introduce the sharp tip of the trocar can be made with the use of a No. 15 or No. 11 blade. However, the authors have more recently used the sharp trocar to introduce the stiff arthroscopic cannula through the skin and soft tissues before advancement of the cannula into the joint with the use of the blunt obturator. Distention of the joint is not necessary before cannula placement; this is aided by the previously administered 20 to 30 mL of local anesthetic. Additionally, the caudal aspect of the medial femorotibial joint is usually done after the cranial compartment, thus providing some caudal distention, which the authors believe aids entrance.

The cranial compartment of the medial femorotibial (MFT) joint is assessed from a standard approach lateral to the lateral patellar ligament and then from a cranial approach between the lateral and middle patellar ligaments in either flexed or extended limb positions (Fig. 4A). The lateral approach optimizes visualization of the cranial ligament and axial portion of the medial meniscus. The cranial approach allows easier visualization of the intercondylar area (cruciate ligaments) and the medial collateral ligament (Fig. 5). The caudal approach to the MFT uses the description of Trumble et al and can be used in both flexed and weight-bearing positions (Fig. 4). The authors’ approach of choice to the cranial compartment lateral femorotibial (LFT) joint is that first described by Moustafa et al, with the use of the previous lateral portal (lateral to the lateral patellar ligament) to the cranial MFT joint, although the portal for the cranial MFT joint also can be used to help visualize more lateral structures. The caudal pouch of the LFT joint is entered through an approach that is 2.5 cm proximal to the tibial plateau and 3 cm caudal to the lateral collateral ligament; the authors have only performed this in the flexed position. The femoropatellar joint is entered through a standard craniolateral approach with the limb extended.

A combination of these approaches allows a complete examination of the stifle. It should be noted that all movements of the cannula around the joint should be made by placing pressure on the cannula itself and not on the scope or camera because these are prone to breakage (Fig. 6). The authors have not experienced this and typically use a single scope for four to five procedures or until visible damage to the scope is observed.

### 3. Results

The proof of principle for this technique has been confirmed and included diagnostic examination of
cadaver stifles followed by examination in normal stifles of standing horses.

To date, the authors have identified a broad range of lesions with the use of the needle scope. These include full-thickness cartilage erosion of articular cartilage (Fig. 7) and horizontal articular cartilage lacerations, an axial lesion of the medial meniscus (Fig. 8), and a loose body identified in the intercondylar area (undetected on radiographs and ultrasound) (Fig. 9) have been seen. Other syndromes include a horizontal meniscal lesion (in a weight-bearing stifle) (Fig. 10) and tearing of the cranial ligament of the lateral meniscus (Fig. 11). A vertical radial tear of the cranial horn of the medial meniscus was identified in a weight-bearing stifle. The severity of the lesion could not be fully appreciated during the standing procedure. The lesion was confirmed through standard arthroscopy in which the full extent of the tear was detected by probe manipulation. In cases in which therapeutic arthroscopy (under general anesthesia with the use of...
a standard 4-mm arthroscope) has been indicated, on the basis of the diagnostic evaluation with the use of the needle arthroscopy standing, abnormalities identified have been similar with both techniques. Although the authors have not specifically recorded procedure time on the basis of the length of video captured during the procedure, the time in the joint is estimated as 4 to 10 minutes per joint. The preparation time is estimated at approximately 30 minutes.

4. Discussion

To date, the authors have found this procedure to be well tolerated by most horses, and no morbidity has been ascribed to the procedure (90+ stifle joints). In the authors’ experience, how the horse responds to the intra-articular anesthetic procedure is a reasonable “gauge” of how the horse will tolerate the standing procedure. All horses that have been scheduled to undergo the procedure have been cooperative enough to allow for diagnostic evaluation of the intended joints, with the exception of one horse.

The procedure has allowed diagnostic information to be gained on horses with questionable diagnoses on the basis of other conventional diagnostic techniques. The procedure has benefit in the quick and relatively atraumatic format of the technique, allowing the clinician to provide a more accurate diagnosis for the patient. Currently, if a surgical lesion is diagnosed, routine therapeutic arthroscopy can be recommended. If a surgical lesion is not identified, medical treatment can be recommended. In the authors’ opinion, a better rehabilitation procedure can

Fig. 7. Full-thickness erosion on the medial condyle (outlined by black arrows) just adjacent to the medial tibial eminence (right side).

Fig. 8. Full-thickness lacerations in the medial condyle (left) adjacent to a medial meniscal lesion (right).

Fig. 9. Arthroscopic view of loose osteochondral fragment (A) in the intercondylar area.

Fig. 10. Image of the cranial compartment of the MFT, weight-bearing position. Black arrows delineate the margin of the proximal articular margin of the medial condyle and reflection of synovial membrane. Green arrows delineate the proximal border of the medial meniscus. Orange arrows delineate the horizontal tear in the medial meniscus, which was noted to become larger as the horse became more non-weight-bearing.
be constructed with a more accurate knowledge of the health of the articular cartilage and intra-articular soft-tissue structures.

As expected, the field of view is smaller than that of a standard 4-mm arthroscope, but this was not considered to be a significant limitation. In fact, in the authors’ opinion, the 18-gauge arthroscope provides a better exploratory of the stifle joint than would be obtained with a 2.7-mm arthroscope. Further, the resolution of the system was good at $640 \times 480$, for still and video capture. Because an egress portal is not routinely used, joint fluid is not flushed through the joint, which can cause visibility issues and require egression of the joint fluid.

In summary, the authors believe that clinical cases that have the following components are good candidates for this procedure: (1) pain regionalized to the stifle with the use of intra-synovial anesthesia, (2) lack of a definitive radiographic diagnosis, (3) definitive ultrasonographic diagnosis missing or unclear, and (4) owner’s unwillingness to allow general anesthesia without a clear diagnosis.

References and Footnotes

*18-Gauge needle arthroscope (1.3-mm diameter), BioVision Technologies, 221 Corporate Circle, Suite H, Golden, CO 80401.
*Kimzey Leg Save Splint, Kimzey, Inc, 164 Kentucky Avenue, Woodland, CA 95695.